U.S. DEPARTMENT OF ENERGY

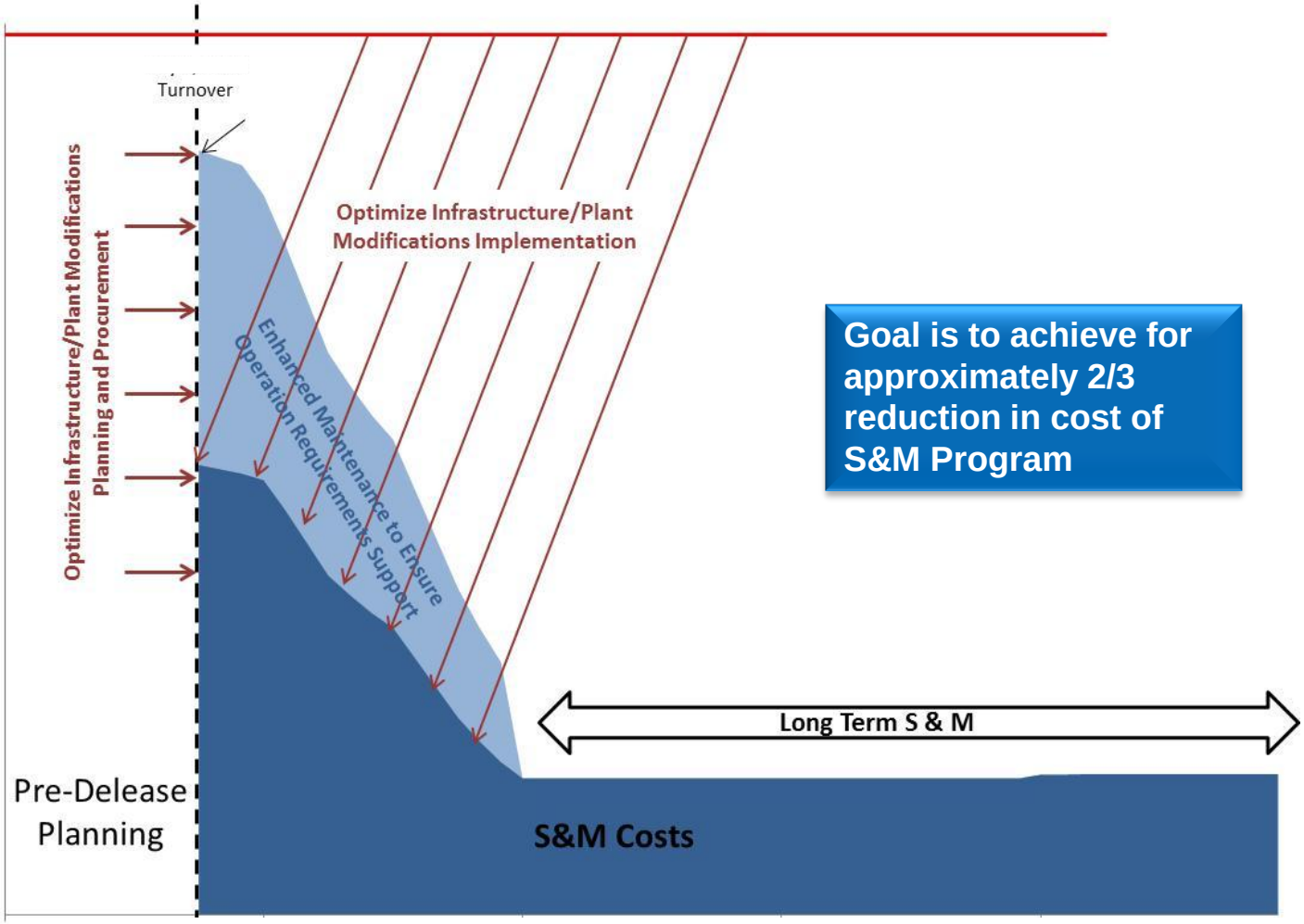
Paducah Gaseous Diffusion Plant Deactivation Task Order Facility Deactivation and Infrastructure Optimization

April 30, 2013

Facility Stabilization and Deactivation C.1.3 - (Period 3)

- After facilities are turned over by USEC and accepted by DOE:
  - Perform minimal stabilization and deactivation activities for facilities to put into safe configuration for long-term S&M.
  - Submit a Stabilization and Deactivation Plan.
  - Perform the necessary facility stabilization and deactivation activities including, but not limited to, the following:
    - ✓ Evaluate and determine the need for the continued safety requirements for monitoring and/or maintaining systems.
    - ✓ Perform deactivation and/or verification activities that support facilities stabilization, per DOE O 420.1B, Facility Safety and contractor safety basis documentation.
    - ✓ Perform uranium deposit/hold-up removal or Tc-99 treatment necessary to minimize long-term S&M cost.

Goal for S&M and Utility Operations



Goal is to achieve for approximately 2/3 reduction in cost of S&M Program

Facility Stabilization and Deactivation C.1.3.1 - Uranium Hold-up/Deposits

- Due to enormous surface area of the uranium process systems within the Paducah cascade, a significant amount of uranium has been chemically and physically absorbed to the inner walls of the piping and cell components (commonly referred to as hold-up)
- It has been estimated as much as 7,500 kgs of uranium may be present.
- Uranium deposits are also caused by wet air in leakage.
  - ✓ The moisture in the air upon entering the cascade reacts with UF_6 to form various uranium oxy-fluorides with the most common being UO_2F_2 and are deposited near the leak.
  - ✓ The uranium deposits can range from a few pounds caused by seal failures to several hundred pounds from expansion joints.
  - ✓ It is estimated to be approximately 5,000 lbs of UO_2F_2 within the cascade.

Facility Stabilization and Deactivation C.1.3.1 - Technetium-99

Estimates have been made that approximately 540 to 550 kilograms of Tc-99 were fed into the PGDP cascade between 1953 and 1977.

- ✓ Approximately 325 kgs were fed into the cascade during period 1953 to 1962.
- ✓ Approximately 214 kgs were fed into the cascade during the period 1962 to 1983.
- ✓ No Tc-99 was fed into the cascade during the period 1983 to present.

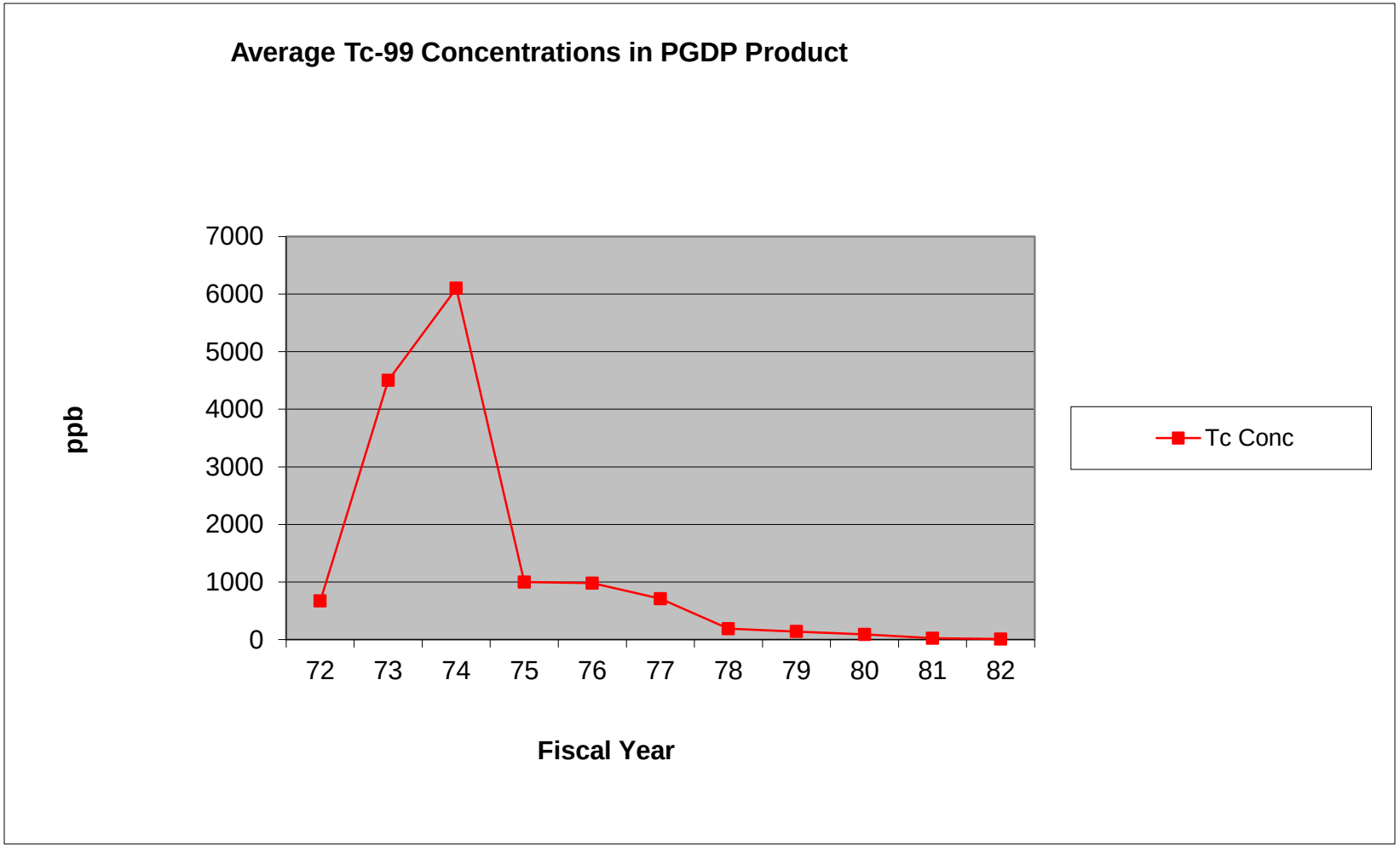
Facility Stabilization and Deactivation C.1.3.1 - Technetium-99 (Cont.)

- ✓ The first large scale CIP began in 1956 and concluded in 1962.
  - Most all of the stages were removed, cleaned or decontaminated and new barrier installed in the first cascade improvement program which was concluded in July 1962.
- ✓ The second CIP began in 1975 and concluded in 1983.
  - The converters were replaced in the purge cascade with converters obtained from K-27 in Oak Ridge. Tc-99 should have been less than what was present on the existing purge cascade converters at that time because of the anticipated higher levels of Tc-99 in the Paducah purge cascade at that time.
  - Approximately 11 kgs of Tc-99 were removed by MgF_2 traps located in C-310 purge cascade in a 10-month period of time. It is uncertain how many trap change outs were performed.

Facility Stabilization and Deactivation C.1.3.1 - Technetium-99 (Cont.)

- Equipment failures, UF_6 trapping media, C-310 vent and UF_6 product are some of the paths where Tc-99 are removed from the cascade.
- During each CIP significant amounts of Tc-99 were removed from the equipment.
- The estimated amount of Tc-99 remaining in the cascade is less than 50 kgs.
- The Tc-99 is not evenly distributed in the cascade. Highest concentrations are in upper cells near the purge cascade and very low concentrations are in the cells near the tails withdrawal.
- Historical UF6 sampling program of product and tails UF_6.
- USEC Tc-99 product specifications for Tc-99.

Facility Stabilization and Deactivation C.1.3.1 - Technetium-99 (Cont.)



Facility Stabilization and Deactivation C.1.3.2 - Utility Optimization (Period 3)

- Ensure decisions for optimizing utilities and laboratory services are based on documented cost/benefit analyses that evaluate overall costs to DOE.
- Use energy savings performance contracts to the maximum extent possible where determined to be cost effective.
- Support the continued analytical services to the DUF_6 Conversion Plant, the on-going environmental remediation and other site tenants/contractors.
- Use/need of utilities for its operations is minimized to the maximum extent and work aggressively to isolate and shutdown GDP and associated support facilities at the site.
- Submit and implement a Utility Optimization Program Plan consistent with the Federal Energy Management Program and DOE Order O 436.1, where applicable.

C-611 Water Treatment and Distribution Facilities

- ✓ Assess the capabilities for purposes of transferring these DOE assets to local community water districts or for deactivating the on-site water treatment facilities and relying solely on community water districts water supplies.

- ✓ Assess the site's near-term and long-term DOE operational needs.

✓The C-611 Water Treatment System provides the water supply to the Paducah Site.

✓Currently, an average 26 million gallons per day (mgd) is required with a peak of 30 to 32 mgd usage.

✓The water treatment process is based on conventional water treatment techniques which include softening, coagulation, flocculation, sedimentation, and chlorination. Raw water is obtained from the Ohio River through an intake station and pumped through water-softening units at the facility.

C-615 Sewage Disposal Plant

- ✓ Assess the capabilities of the on-site sewage collection and treatment systems and facilities for purposes of replacing these facilities through use of more efficient modular treatment systems or use of local community sewage treatment districts.
- ✓ Assess the site's near-term and long-term DOE operational needs.

- ✓ The C-615 Sewage Disposal Plant provides the sewage handling and treatment for the Paducah Site.
- ✓ Sewage is handled by four 400 gallons per minutes (gpm) basin pumps and 75 gpm sludge pumps which provide a basic plant capacity of 350 gpm. Normal flow is between 200 and 300 gpm.
- ✓ The sewage collection system services all the occupied plant buildings with the exception of some remote facilities.
- ✓ The plant consists of chemical, mechanical, and biological treatment prior to discharge.
- ✓ The pant provides secondary treatment. It consists of a comminutor, primary and secondary settling basins, trickling filter, sludge digester and settling beds, chlorinator, and contact chamber.

Power Distribution

- Assess the capabilities and configuration of the on-site power distribution system and facilities for purposes of:
  - ✓ 1) consolidating on-site power distribution to the C-531 Switchyard as quickly as possible,
  - ✓ 2) evaluating and determining if construction/installation of a replacement switchyard(s) (high and low side) is cost effective,
  - ✓ 3) transferring options or ownership of the four existing switchyards (C-531, C-533, C-535, C-537), two relay houses (C-532, C-536), and other related support systems/facilities to electrical utilities.
- Assess the site's near-term and long-term DOE operational needs.
- As radiological and PCB contamination exists in the switchyards and on/near associated support facilities and assets, any recommendation must ensure appropriate controls are in place to properly control contaminants and ensure protection of personnel entering or commercially utilizing the facilities and systems.

Power Distribution

Switchyards

- ✓ C-531, C-533, C-535, and C-537 switchyards contain the 161kilovolt (kV) electrical system components necessary for operation of the PGDP.
- ✓ The plant typically uses between 900 megawatts and 2000 megawatts of electrical power per hour, depending on the plant's production targets and availability of reasonably priced power.
- ✓ The plant was built with the capacity to use up to 3000 megawatts.
- ✓ Electrical power comes into the plant at 161,000 volts through the overhead transmission lines from TVA's Shawnee Steam Plant and Electric Energy, Inc. (EEI) at Joppa, Illinois.
- ✓ The power flows through more than 80 circuit breakers to large transformers (35) located throughout the plant.

Power Distribution

Switchyards

- ✓ Of the eighteen transmission lines entering the PGDP, twelve are owned by the Tennessee Valley Authority (TVA) and six are owned by EEI.
- ✓ Kentucky Utilities owns one line that comes to the plant and goes out but does not provide feed to the plant.
- ✓ In addition the four PGDP switchyards are connected by five 161kV tie lines owned by DOE and leased by USEC.

C-600 Steam Plant Shutdown

- ✓ Deactivate and shutdown the C-600 Steam Plant. However, heat, compressed air, nitrogen, and chilled water will still be required for certain facilities that currently utilize the RCW system (residual heat).
- ✓ Evaluate the site's need (including tenants/contactors) for heat, compressed air, nitrogen and chilled water, which will include alternate sources, properly sized, for the utilities and upon approval by DOE, implement the modifications.

- ✓ The plant produces steam used to heat, vaporize UF_6, obtain UF_6 samples, maintain process temperatures, clean equipment, and provide heat for other miscellaneous buildings and process operations.
- ✓ It consists of three water wall tube boilers (two coal-fired and one oil-and gas-fired) each capable of producing 100,000 pounds of steam per hour at 250 pounds per square inch plus associated equipment.
- ✓ Some of the site facilities such as C-100, C-300, and C-710 currently utilize the chilled water system for building air conditioning and the steam for heating.
- ✓ The use of electrostatic precipitators and low-sulpher coal helps the plant keep atmospheric emissions below environmental limits. The steam plant uses approximately 35,000 tons of coal per year.

Alternative Heat and Chilled Water Systems

- ✓ Provide a provision of an alternative heat supply to the facilities currently utilizing waste heat for facility heating systems.
- ✓ Evaluate modifications to the chilled water system to provide air conditioning for the C-100, C-101, C-102, C-200, C-300, C-400 office areas, C-710 and C-720 office areas that are currently cooled.
- ✓ Facility modifications should be sized and installed only for these facilities/areas which the Contractor (or the other site's contractors/tenants) expects to utilize for support of this PWS.

- ✓ Systems were designed and built to pump heated recirculating cooling water (RCW) from the process buildings to the buildings requiring space heating.
- ✓ The pumped water is known as recirculating heating water (RHW).
- ✓ Shutdown of the gaseous diffusion process will result in loss of waste heat source, RCW and RHW, and the internal radiant heat from the process within each buildings.
- ✓ Steps must be taken to provide alternate sources of heat or to winterize the buildings if the uranium enrichment process is shutdown.

Analytical Laboratory

- ✓ Assess the capabilities of the on-site Analytical Laboratory (C-709 and C-710) for purposes of privatization of the facilities and equipment.
- ✓ Assess the need of analytical services (lease, transfer, or purchase) from existing on-site tenants/contractors to determine the type of analytical services needed.

✓The C-709 Plant Laboratory Annex and the C-710 Technical Services Building house laboratories with an array of modern analyzers and test equipment, offices, a conference room, and vault for records retention and storage.

✓The laboratory facilities analyze over 100,000 various types of analytical tests per year, such as analyzing for metals, radiological, organics, inorganics, volatiles, and semivolatiles.

✓Media types such as groundwater, concrete, soil, air, waste waters are processed through the laboratory, also supporting the environmental cleanup programs.